What is claimed is:

1. A method of producing on-demand, semi-solid material for a casting process, said method comprising the following steps:

heating a metal alloy until it reaches a molten state;

transferring an amount of said molten alloy to a vessel;

cooling said amount of molten alloy in said vessel;

applying an electromagnetic field to said amount of molten alloy for creating a flow pattern of said molten alloy within said vessel while said cooling continues in order to create a slurry billet; and

discharging said slurry billet from said vessel into a shot sleeve of a casting machine.

2. The method of claim 1 wherein the performance of the transferring, cooling, applying, and discharging steps has a total cycle time of between 4 seconds and 250 seconds.

3. The method of claim 2 wherein said transferring step is performed in between approximately 2 seconds and 35 seconds.

4. The method of claim 3 wherein said cooling and said applying steps are performed in a combined time of between approximately 2 seconds and 120 seconds.

5. The method of claim 4 wherein said discharging step is performed in between approximately 0.1 second and 30 seconds.

6. The method of claim 1 wherein said transferring step is performed in between approximately 2 seconds and 35 seconds.

7. The method of claim 1 wherein said cooling and said applying steps are performed in a combined time of between approximately 2 seconds and 150 seconds.

8. The method of claim 1 wherein said discharging step is performed in between approximately 0.1 seconds and 30 seconds.

9. The method of claim 1 wherein said transferring step includes the use of a robotic arm and a cooperating ladle.

10. The method of claim 9 wherein said applying step is performed by moving said vessel into a stator before said transferring step is performed.

11. The method of claim 10 wherein said cooling step is performed by providing a flow of cooling air between said vessel and said stator.

12. The method of claim 10 which further includes the step of clamping a thermal jacket around said vessel, said thermal jacket being positioned within said stator and said clamping step occurring before said transferring step.

13. The method of claim 1 wherein said applying step is performed by moving said vessel into a stator before said transferring step is performed.

14. The method of claim 1 wherein said cooling step is performed by providing a flow of cooling air between said vessel and said stator.

15. The method of claim 1 which further includes the step of clamping a thermal jacket around said vessel, said thermal jacket being positioned within said stator and said clamping step occurring before said transferring step.

16. The method of claim1 wherein said transferring step includes the use of an automatic mechanical ladle.

17. The method of claim 1 wherein said stator is a multi-phase, multiple pole stator using circumferential flow in the molten metal.

18. The method of claim 1 wherein said stator is a multi-phase, multiple pole stator causing longitudinal flow in the molten metal.

19. The method of claim 1 which further includes the step of adding particulate solid particles into the metal alloy for forming a metal matrix composite.

20. An apparatus for producing on-demand, semi-solid material for a casting process, said apparatus comprising:

a vessel constructed and arranged for receipt of an amount of molten alloy;

means for moving said vessel between a forming station and a discharge location;

a stator constructed and arranged for effecting electromagnetic stirring of the amount of molten alloy, said vessel being positioned within said stator; and

cooling means for lowering the temperature of said amount of molten alloy while said electromagnetic stirring is performed so as to produce a slurry billet within a comparatively short cycle time which is less than three minutes.

21. The apparatus of claim 20 wherein said cooling means includes a thermal jacket positioned between said stator and said vessel.

22. The apparatus of claim 21 wherein said thermal jacket has a split-half design and is constructed and arranged so as to be openable prior to receiving said vessel and to be closeable so as to clamp around said vessel.

23. The apparatus of claim 20 which further includes discharge means for removing the slurry billet from the vessel and loading it into a shot sleeve of a casting machine.

24. A method of producing shaped metal parts from on-demand, semi-solid metal with degenerate dendritic primary solid particles, said method comprising the following steps:

heating a metal until it reaches a molten state;

transferring an amount of said molten metal to a vessel, while controllably cooling said amount of molten metal in said vessel;

applying an electromagnetic field to said amount of molten metal for creating a flow pattern of said molten metal within said vessel until a desired molding temperature within the semi-solid range is reached, thereby creating a slurry; and

discharging said slurry from said vessel into a shot sleeve of a casting machine.

25. The method of claim 24 which further includes the step of operating said casting machine in order to cast the slurry into the form of a shaped metal part.

26. The method of claim 25 wherein the performance of the transferring, cooling, applying and discharging steps has a total cycle time of between 4 seconds and 250 seconds.

27. An apparatus for producing shaped metal parts from on-demand, semi-solid metal with degenerate dendritic primary solid particles, said apparatus comprising:

a vessel constructed and arranged for receipt of an amount of molten alloy;

means for moving said vessel between a forming station and a discharge location;

a stator constructed and arranged to generate sufficient electromagnetic forces for stirring the amount of molten alloy, said vessel being positioned within said stator; and

cooling means for lowering the temperature of said amount of molten alloy while said electromagnetic stirring is performed so as to produce a slurry billet within a comparatively short cycle time which is less than 4 minutes.

28. The apparatus of claim 27 which further includes discharge means for transferring said slurry billet from the vessel into a shot sleeve of a forming press.

29. The apparatus of claim 28 wherein said cooling means includes a thermal jacket positioned between said stator and said vessel.

30. An apparatus for producing shaped metal parts, on-demand, from a metal alloy having particulate solid particles as a metal matrix composite, said apparatus comprising:

a vessel constructed and arranged for receipt of an amount of said metal matrix composite;

means for moving said vessel between a forming station and a discharge location;

a stator constructed and arranged to generate sufficient electromagnetic forces for stirring the amount of molten alloy, said vessel being positioned within said stator; and

cooling means for lowering the temperature of said amount of molten alloy while said electromagnetic stirring is performed so as to produce a slurry billet within a comparatively short cycle time which is less than 4 minutes.